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ABSTRACT

A project was conducted in response to House Joint Resolution (HJR) 143 to determine the efficacy of Virginia public education institutions in preparing a skilled work force for the 21st century. It focused on complex manufacturing technology to identify and implement model procedures for studying other occupational areas. Information was obtained from the literature, representatives of manufacturing businesses, and educators at the secondary, community college, and senior college or university levels. Data collection methods included a mail survey, interviews, and two meetings of educators and business personnel. Findings based on 15 completed surveys (six from large businesses and nine from small businesses) indicated the following: a pattern of little or no employment of entry-level and first-line supervisory personnel by manufacturing firms; employers could be very selective in hiring; no consideration is given to applicants lacking critical competencies for employment; and educators are concerned about placing graduates. Business personnel and educators identified the critical competencies. The major conclusion was that the Virginia work force would not be prepared unless critical competencies were developed. Recommendations focused on coordinating statewide work force preparation efforts and implementing the development of the critical competencies at secondary schools, community colleges, and higher education institutions. (Appendixes include HJR 143, model procedures for study of an occupational area, instruments, entry-level worker and first-line supervisor competencies, and programs from the two meetings.) (YLB)

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REPORT OF THE
DEPARTMENT OF EDUCATION

Study Of Preparing A Skilled Workforce For The 21st Century

TO THE GOVERNOR AND
THE GENERAL ASSEMBLY OF VIRGINIA

HOUSE DOCUMENT NO. 18

COMMONWEALTH OF VIRGINIA
RICHMOND
1993

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
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PREFACE

This project, entitled "Study of Preparing A Skilled Workforce," was conducted in response to House Joint Resolution (HJR) 143, "Requesting the State Board of Education and the State Council on Higher Education jointly to study the efficacy of current education and workforce training initiatives in the Commonwealth's public schools and institutions of higher education in preparing a skilled workforce for the 21st century."

Dr. Kay Brown, Department of Education, and Dr. Genene Pavlidis, State Council of Higher Education, served as leaders of the inter-agency study group. Dr. Myrna DeAustria represented the Virginia Community College System, and the following individuals represented the state agencies indicated: Delores Esser, Virginia Employment Commission; Joseph Holicky, the Governor's Employment and Training Commission; Diane Long, the Center for Innovative Technology; Preston Wilhelm, Department of Economic Development; James Walker, Department of Labor and Industry; and the Department of Education project team including Dr. Glenn Anderson, Rebecca Dedmond, James A. Gray, Jr., Richard Kravitz, Dr. Larry McCluskey, and Warren Hayman from the Department's Virginia Vocational Curriculum and Resource Center.

The study team acknowledges with grateful appreciation the invaluable contributions of business and industry personnel who generously contributed their time and expertise to the project, representing the following organizations: E. I. Dupont--W. R. McDonald, Human Resources Manager, Claude L. Edmonds, Employment Section Manager, and Michael Wall, Human Resources Representative; Ford Motor Company--James A. Stick, Industrial Relations Manager, and Carol Matson, Industrial Relations Representative; IBM--Edward M. Lewis, Site Education Manager; Kosmo Machine Company--Ted Smook, Owner; Merck & Company--Leonard Fields, Associate Personnel Manager, and Steve Harris, Assistant Personnel Manager; Newport News Shipbuilding--James A. Wallace, Director of Training and Development, and Hugh M. Davis, Jr., Manager of Production and Manufacturing Skills Training; Virginia Manufacturers Association--Robert Kyle, Human Resources Director, and John McIlroy, President; and the Rotary Club--W. S. Richardson, Jr., retired president of Bill's Barbecue.

Study team leaders and members are grateful also to the institutions of higher education and local school divisions that provided representatives for focus groups as well as enthusiastic support for the project: James Madison University, George Mason University, Old Dominion University, Virginia Commonwealth University, Virginia State University, Virginia Polytechnic Institute and State University, the University of Virginia, the Virginia Military Institute, J. Sargeant Reynolds Community College, Virginia Highlands Community College, Virginia Western Community College, Thomas Nelson Community College, Roanoke County Public Schools, Massanutten Technical Center, Rockingham County Public Schools, Brunswick County Public Schools, Henrico County Public Schools, and Richmond Public Schools.

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WORKFORCE 2000: WILL VIRGINIA BE PREPARED?

If the current trend in complex manufacturing technology continues, only those applicants who can demonstrate the critical competencies identified in the study are likely even to be considered for employment. If students at all instructional levels are to be prepared for the present and future workforce, they must be specifically, practically, and realistically prepared for a very challenging and demanding job and career scenario with nothing certain but change. In the opinion of the study team, the Virginia workforce **will not** be prepared for the 21st century unless the critical competencies are developed.

EXECUTIVE SUMMARY

The purpose of HJR 143, introduced by Delegate Robert Harris of Fairfax County, was to determine the efficacy of state public education institutions in preparing a skilled workforce for the 21st century. To accomplish this purpose, HJR 143 authorized a study to be conducted by the State Board of Education and the State Council of Higher Education, in cooperation with the Virginia Community College System. The implied, underlying question of HJR 143 was, "Will the Virginia workforce be prepared for the 21st century?" To begin answering this critical question, the study team focused on the field of complex manufacturing technology and on both entry-level and first-line supervisory positions to identify and implement model procedures for studying other occupational areas. The decision to concentrate on the manufacturing industry was based on the emphasis in HJR 143 on numerical-control machinery, computer-integrated and flexible-response manufacturing, and instruction in mathematics and the sciences.

Information was obtained from the literature; from representatives of large and small manufacturing businesses; and from educators at the secondary, community college, and senior college or university levels of instruction. Data collection methods included a mail survey, interviews with manufacturing business personnel, and two project events, "Manufacturing Workforce 2000" and "Focus: Education for Manufacturing Workforce 2000." Both of these events enabled business representatives and educators to discuss issues and develop recommendations for effective workforce preparation programs. Agreement was reached concerning inclusion in workforce preparation programs of the critical competencies identified in this study.

Critical competencies were defined as the workforce skills of the future rated as first in each category of competencies, for entry-level workers and first-line supervisors, by respondents representing both large and small manufacturing firms in Virginia. Categories of competencies included reasoning and problem solving, speaking and listening, teamwork, personal work habits, reading, writing, computation, and business principles. Critical competencies for **entry-level workers** were identified as follows: devise new ways of handling recurring problems; participate effectively in discussions; participate as a team member toward a common goal; exhibit a willingness to learn; assimilate the contents of technical documents and memos; gather information necessary for a purpose; add, subtract, multiply, and divide whole numbers, decimals, and fractions accurately; and understand the roles of money, capital, investment, product pricing, cost, profit, and productivity. Critical competencies for **first-line supervisors** included the following: consider and evaluate possible alternative solutions, weighing both risks and benefits; give clear, concise instructions; demonstrate respect for the opinions, customs, and

individual differences of others; exhibit a willingness to learn; assimilate the contents of technical documents and memos; organize information in a logical and coherent manner; determine the cost, time, or resources necessary for a task; and understand the roles of money, capital investment, product pricing, cost, profit, and productivity.

The major conclusion of this study is that the Virginia workforce will **not** be prepared for the 21st century unless the critical competencies are developed. This and supporting conclusions are based on findings of the study, particularly changes in required workforce skills that require adaptations in workforce preparation, such as a shift from task to project, an increase in teamwork, an ability to work without direct supervision, a higher level of cognitive ability required for workers, and an increased understanding of global economic principles.

If the current trend in complex manufacturing technology continues, only those applicants who can demonstrate the critical competencies are likely even to be considered for employment. If students at all instructional levels are to be prepared for the present and future workforce, they must be specifically, practically, and realistically prepared for a very challenging and demanding job and career scenario with nothing certain but change. Although this major conclusion and other supporting conclusions are specific to the Commonwealth of Virginia and to the field of complex manufacturing technology, they may have broader application.

Recommendations of the study focus on coordinating statewide workforce preparation efforts and implementing the development of the critical competencies at three instructional levels--secondary schools, community colleges, and senior higher education institutions. The following recommendations, which are based on findings of the study and are intended to apply to all workforce preparation, are offered as measures to help ensure that the Virginia workforce will be ready for the 21st century:

1. The Workforce Leadership Council (WLC), composed of agency heads with employment and training responsibilities, should coordinate the various workforce preparation studies and initiatives to produce a statewide program designed to ensure development of the critical competencies identified in this study.

2. The workforce preparation program should include implementation and evaluation of efforts to develop the critical competencies; provision for youth and adults who have had no opportunities to be prepared for the present or future workforce; and a public information campaign to inform students, parents,

educators, and employers of the urgency of workforce preparation for the 21st century.

3. A team of business representatives and educators representing secondary schools, community colleges, and senior educational institutions should formulate recommendations for development of the critical competencies at appropriate levels of depth and complexity, including staff development programs focusing on workforce issues and trends in relation to the counseling and career preparation of students.

4. Whenever possible, secondary schools, community colleges, and senior colleges and universities should provide supervised employment or simulated workforce experience for all students, as well as career counseling services.

5. Partnerships with employers should be expanded to facilitate the development of the critical competencies, to arrange for actual or simulated employment opportunities for students and faculty, and to determine the critical competencies that could be taught by business representatives. The Business/Education Partnership Program and Resource Center could assist in this endeavor, and individuals at educational institutions could coordinate education/business and industry relationships and staff development in workforce issues and trends.

6. The Department of Education, within its comprehensive educational restructuring effort, should fully implement the following actions, which are already underway and which reflect the systemic changes envisioned by the State Board of Education in its adoption of the document, "Virginia's Vision For A World-Class Education":

   a. The Common Core of Learning (to be completed at the end of the tenth grade);

   b. Development of the eleventh- and twelfth-grade instructional programs;

   c. Further development of Tech Prep programming, in cooperation with the Virginia Community College System, to enable qualified students to begin this comprehensive, multi-level curriculum while in secondary school; and

d. Continuing development of the apprenticeship program, in cooperation with the Department of Labor and Industry, to meet the needs of small businesses as well as to provide new employment opportunities for students.

ABSTRACTS OF APPENDICES

There are eight appendices included in the final report of HJR 143: Study of Preparing A Skilled Workforce:

Appendix A. House Joint Resolution No. 143

Appendix A. contains a copy of HJR 143, General Assembly resolution authorizing this study.

Appendix B. Model Procedures for Study of An Occupational Area: Complex Manufacturing Technology

Appendix B. is a list of the procedures included in the study of complex manufacturing technology, which may serve as model procedures for studying other occupational areas.

Appendix C. Mail Survey Instrument and Interview Questions: Information from Manufacturing Businesses

Appendix C. includes instruments used in the study--the mail survey form and the interview questions designed to obtain information on workforce needs from manufacturing businesses.

Appendix D. Entry-Level Worker Competencies Present and Future Large and Small Manufacturing Businesses

Appendix D. provides the detailed data on desired characteristics of entry-level workers in manufacturing, including present and future required competencies, responses from large and small manufacturing businesses, and combined responses.

Appendix E. First-Line Supervisor Competencies Present and Future Large and Small Manufacturing Businesses

Appendix E. focuses on the competencies of first-line supervisors in manufacturing, including present and future required skills, responses from large and small manufacturing businesses, and combined responses. Also located in Appendix E. is a list of the Dupont criteria for first-line supervisor selection.

Appendix F. Additional Response Categories: Science and Technology and Other Competencies

Appendix F. is a summary of two supplementary response categories from the mail survey of manufacturing businesses, including science and technology competencies and other competencies.

Appendix G. Project Event #1: "Manufacturing Workforce 2000"

Appendix G. contains the program and a list of participants for the first project event, "Manufacturing Workforce 2000," held on July 24, 1992.

Appendix H. Project Event #2: "Focus: Education for Manufacturing Workforce 2000" August 24-25, 1992 Program and Participants

Appendix H. provides the program and a list of participants for the second project even, "Focus: Education for Manufacturing Workforce 2000," held August 24-25, 1992

CHAPTER I. INTRODUCTION

The purpose of House Joint Resolution 143, introduced by Delegate Robert Harris of Fairfax County, was to determine the efficacy of state public education institutions in preparing a skilled workforce for the 21st century. To accomplish this purpose, HJR 143 authorized a study to be conducted by the Department of Education and the State Council of Higher Education, in cooperation with the Virginia Community College System (Appendix A).

The implied, underlying question of HJR 143 was, "Will the Virginia workforce be prepared for the 21st century?" To begin answering this critical question, the study team focused on the field of complex manufacturing technology to identify and implement model procedures for studying other occupational areas. The decision to concentrate on the manufacturing industry was based on the emphasis in HJR 143 on numerical-control machinery, computer-integrated and flexible-response manufacturing, and instruction in mathematics and the sciences. Application of the model to additional career clusters is necessary, however, to answer definitively the question of state workforce preparedness for the 21st century.

Objectives of the study were as follows:

1. To collect, review, and summarize literature on workforce preparation for the 21st century;

2. To obtain information from large and small manufacturing businesses concerning employment trends and employee skills desired by these employers now and in the future;

3. To determine from educators in public education at three levels of instruction (secondary, community college, and senior college or university) the feasibility of incorporating any career preparation changes into the curriculum of manufacturing-related programs;

4. To respond to the question of Virginia workforce preparedness for the 21st century, based on the manufacturing manufacturing model; and

5. To formulate recommendations for future workforce preparation in the Commonwealth to enable students to compete in an ever-changing global economy.

Background information on workforce issues addressed in this study may be summarized in relation to manufacturing in Virginia, education for manufacturing occupations in Virginia, employment trends, and workforce preparation.

Manufacturing in Virginia

The Virginia Department of Economic Development's recent publication, 1992 Facts and Figures, reveals pertinent statistics concerning the importance of manufacturing in Virginia. Manufacturing provides jobs for almost 413,000 persons in more than 6,400 firms and accounts for 14% of total non-agricultural employment. Unlike the nation, Virginia's manufacturing employment has not slipped below its 1970 and 1991 level during downturns in the economy. The Commonwealth's manufacturing sector has shown a 12.8% employment increase between 1970 and 1991, while national manufacturing employment declined by 4.7%. Manufacturing employment is found in every county and city in the state. Eighty-one counties and cities have 1,000 or more manufacturing employees; 26 have 5,000 or more. In spite of these positive statistics, however, representatives of state manufacturing firms participating in this study reported little or no employment of entry-level workers or first-line supervisors during the past year or longer.

Education for Manufacturing Occupations in Virginia

Approximately 7,000 new manufacturing jobs were filled during 1991, according to 1992 Facts and Figures. Virginia's high schools, community colleges, and senior institutions of higher education supplied many of the graduates to fill these new jobs. Each of the 449 accredited high schools in the Commonwealth offers at least one vocational program, and more than 80% provide five or more occupational programs. The vocational program area of Trade and Industrial Education prepares students for manufacturing-related occupations, as well as numerous other careers.

The Virginia Community College has the major responsibility for establishing and operating occupational-technical programs at the postsecondary level. During the 1990-91 school year, more than 79,000 students were enrolled in vocationally related courses and programs. In addition, 848 associate degrees were conferred in engineering and engineering-related technologies.

State-supported senior institutions of higher education produced approximately 2,650 graduates with engineering degrees in 1990-91. Of this total, 15 associate degrees, 1,758 bachelors degrees, and 150 doctoral degrees were conferred. The programs in engineering and engineering-related technologies include specializations in electrical, electronics, communication, mechanical, civil, aerospace, aeronautical, astronautical, industrial, chemical, and systems engineering.

Other state agencies also provide occupational preparation services to youth and adults: the Department of Labor and Industry operates the state apprenticeship system; the Department of Rehabilitative Services coordinates employment and training

services for persons with disabilities; the Department of Correctional Education provides vocational programs in the state's correctional institutions; the Virginia Employment Commission assists in providing comprehensive employment and training services; and the Virginia Department of Economic Development's Workforce Services Section offers training and assistance for new and expanding industries throughout the Commonwealth.

Employment Trends

According to statistics provided in Virginia's Workforce 2000 (1991), unemployment is likely to decline to 3.3% in Virginia and 4.5% nationally by the year 2000. As the workforce ages, the education and skills of those currently in the workforce and those who are chronically unemployed will assume greater importance in determining the competitive position of the South's economy (MDC, Inc., 1992). In fact, approximately 70% of the South's workers in the year 2010 already are on the job today. This suggests a need not only for education but also re-education.

As reported in Virginia's Workforce 2000 (1991), the greatest number of new jobs is expected in the professional, paraprofessional, and technical categories, including the manufacturing-related occupations of engineers, scientists, and technicians. Coupled with the predicted employment growth in these categories is the report by 10% to 24% of southern manufacturers that there are shortages of skilled craft workers, technicians, and technical professionals (MDC, Inc., 1992). These jobs require increasingly complex skills for career survival and advancement as well as global competitiveness of the worker and the organization.

In addition, there is a trend toward "defensive credentialing," forcing workers to upgrade their credentials for licensing, initial employment, and especially for promotion (Atwell, 1992). This may be in part a reaction to the reduction in the number of desirable jobs.

In a recent essay, "The Family Crucible and Healthy Child Development," Hamburg (1992) reports that "in the past few decades the shift from manufacturing to a service-based economy has brought a decline in wages for many people. The industries that have declined in the United States in relation to foreign competition are precisely the ones that historically provided relatively high-earning positions" (p. 8).

A 1992 article published by Fortune magazine further illustrates the effect of these changes in compensation. Nearly five million workers placed in the 13.6 million full-time jobs added in the United States between 1979 and 1989 received less than $250 a week, or $13,000 a year, after adjusting for inflation, a figure below the official poverty level for a family of four.

These jobs tend to offer little or no opportunities for promotion, health benefits, or pensions (O'Reilly, 1992). In addition, there is a particularly disturbing trend of closing United States plants and opening new ones in Korea, Portugal, and other countries where production workers receive very low wages.

Employment trends and concerns in Virginia tend to reflect the national data reported in the literature.

Workforce Preparation

Over the past decade, a number of studies at both the state and national levels have been generated to assess the worker competencies needed for global competition. This research has been stimulated by such factors as the decrease in the number of workers as the population curve of the baby boom flattens; a re-examination of educational needs; the rising costs of employment; and down-sizing, restructuring, and the recession.

The problem of restoring global competitiveness does not exist within education alone. In America's Choice: High Skills or Low Wages!, published by the Commission on the Skills of the American Workforce (1990), the authors note that the educational system produces "minimal educational effort or achievement among our students who are not college-bound." Business enterprises, individual workers, and public policy must carry the responsibility, along with educational institutions. Schools historically and necessarily lag behind developments in marketplace technology and cannot be expected to keep stride with these developments. Business, through training and re-training programs, educational incentives for workers, exchange systems for teachers in the workplace, apprenticeships, and other options, have an important part to play in continuing career preparation. The workers themselves must be motivated, take appropriate career education routes, and enhance their self-management and self-development competencies. Finally, public policy can be formulated to facilitate the total improvement process.

Robert Zemsky and Peter Cappelli (1992), for example, in an article titled "The EQW Triangle," offer the following suggestions toward achieving a world-class workforce:

Schools	• Focus more on product, less on process. • Teach core competencies: mathematics, communication skills, citizenship. • Recognize firms, as well as students, as customers.
Enterprises	• Stop blaming the worker. • Manage the enterprise as a portfolio of employee skills.

	• Treat schools as suppliers.
Workers	• Become comparison shoppers for educational purchases. • Invest in broad-based skills for long-term payoff. • Build a productive partnership with the employing firm.
Public Policy	• Improve public schools. • Facilitate local market linkages among enterprises, schools, and workers. • Re-evaluate federal funding of proprietary education.

The roles of educators, employers, workers, and public policy representatives, as described in the literature, will be examined individually following a discussion of critical worker skills required for the 21st century.

Identification of Critical Skills

All studies point to the need to intensify the basic foundation skills and enhance these with enriched technical education. While each report targets different areas and levels of the workforce, this review will focus on skill requirements common to all areas and levels of the workforce.

Competencies identified in all studies may be generally classified into three basic categories of equal importance: **academic** skills, including cognitive, psychomotor, and affective competencies; **personal** skills; and **teamwork** or interpersonal and interaction skills. Technological literacy is viewed as a necessity and placed in the academic skills category, as is understanding the nature of business and problem-solving capabilities.

A review of the literature concerning workforce competencies for the 21st century reveals a variety of systems for categorizing needed skills.

Models for Excellence

In research conducted by the American Society for Training and Development (1983) and published in Models for Excellence, **learning how to learn** was the foundation workplace skill of 16 listed. These 16 skills were divided into seven categories, composed of the following:

1. **The Foundation**--Learning How to Learn;
2. **Basic Competency Skills**--Reading, Writing, and Computation;
3. **Communication**--Speaking and Listening;
4. **Adaptability**--Problem Solving and Thinking Creatively;
5. **Developmental Skills**--Self-Esteem, Motivation and Goal Setting, and Career Development Planning;
6. **Group Effectiveness Skills**--Interpersonal Skills, Teamwork, and Negotiation; and
7. **Influencing Skills**--Understanding Organizational Structure and Sharing Leadership.

Core Competencies

In 1984, the National Academy of Sciences survey of American businesses isolated ten "Core Competencies" required of all workers, regardless of education or specialty. The panel convened in the study consisted of employers, labor union representatives, scholars, and educators, who published their results in High Schools and the Changing Workplace: The Employer's View. The panel summarized its results into three basic findings:

1. **The major asset required in the workforce is the ability to learn new knowledge and skills to adapt to the rapidly changing workplace;**
2. **The Core Competencies are required at all levels in the workforce; and**
3. **Positive attitudes and sound work habits are especially valued by employers.**

The ten "Core Competencies" identified in the study included the following: **command of the English language, reasoning and problem solving, reading, writing, computation, science and technology, oral communication, interpersonal relationships, social and economic studies, and personal work habits.**

The SCANS Report

One central study, led by the Secretary of Labor and conducted by The Secretary's Commission on Achieving Necessary Skills (SCANS, 1991), provides another basic framework of skills. After intensive examination of the American workplace, the Commission concluded that "more than half our young people leave school without the knowledge or foundation required to find and hold a good job." The Commission's report, What Work Requires of Schools: A SCANS Report on America 2000, focuses on the following: **basic skills** (reading, writing, calculating, listening, speaking; **think- ing skills** (creative thinking, decision making, problem solving, visualizing, knowing how to learn); and **personal qualities** (responsibility, self-esteem, sociability, self-management, integrity, and honesty).

The five additional competencies are then identified: an understanding of **resources** (identifies, organizes, plans, and allocates resources; proficiency in **interpersonal** skills (works with others); the capacity to manage **information** (acquires and uses information); a knowledge of **systems** (understands complex interrelationships); and a mastery of **technology** (works with a variety of technologies).

The Commission explains that the work requirements of America today "involve a complex interplay" among the foundation skills and competencies listed. Addressing the need for educational and workplace reform, the SCANS team arrived at three conclusions:

1. **All American high school students must develop a new set of competencies and foundation skills if they are to enjoy a productive, full, and satisfying life;**
2. **The qualities of high performance that today characterize our most competitive companies must become the standard for the vast majority of our companies, large and small, local and global; and**
3. **The nation's schools must be transformed into high-performance organizations in their own right.**

The Virginia Plan for Strengthening the Commonwealth's 21st Century Workplace

Virginia has demonstrated a continuing concern for assessment of workforce preparation. In 1991, the Governor's Advisory Committee Workforce 2000: A Partnership for Excellence published The Virginia Plan for Strengthening the Commonwealth's 21st Century Workforce. As part of the plan, the following categories of competencies are to be included in the Virginia Assessment of Critical Knowledge and Skills: **academic knowledge and skills, personal management skills,** and **teamwork knowledge and skills.**

The competency organizational system emphasized in this report is the identification of **critical competencies** resulting from the study and presented in Chapter II. This system is a synthesis of all the classifications of skills described in the literature and includes the competency categories identified in The Virginia Plan for Strengthening the Commonwealth's 21st Century Workplace.

The Role of Educators

Schools, colleges, and universities can do much to change the curricula to reflect the organizational world in which graduates find themselves working. In a 1991 dissertation, Holton states,

"Universities must change their perspective on measuring their success from just helping students get a job and preparing them for the tasks they will perform to providing all the tools necessary for a graduate to have a successful career beginning" (p. 148). Counseling and other employment-related student services are needed to facilitate the transition from school or college to work.

The need for remediation is a concern of both educators and employers. The State Council of Higher Education has reported that 14.19% of high school graduates who attended a state-supported college or university for the first time in 1991-92 required remedial courses. This report marks the first time that the state has tracked students from high school to college to help determine if their secondary education was adequate, and if not, how this might be improved. Information is not yet available concerning the remedial needs of non-college high school graduates. According to a report published by MDC, Inc. (1992), 25% of Virginia adults age 25 and older are high-school dropouts and in need of further education. This need for remedial instruction affects the cost of employment. For example, a 1988 Motorola study highlighted in Workplace Basics: The Essential Skills Employers Want showed that a Japanese student can be moved into the workplace at an employer cost of $.47, while an American student's transition costs the employer $2.26 (Carnevale, Gainer, and Meltzer, 1991).

Several promising initiatives are underway to alleviate the remediation problem, to strengthen linkages to the workplace, and to develop worker skills for the 21st century. First, "World-Class Education" standards have been developed by the Board of Education, with emphasis on a Common Core of Learning (CCL) that includes an interdisciplinary approach to the dimensions of living and fundamental skills needed for living, learning, and working. This Common Core of Learning, along with an accountability system to measure how well students are progressing, should help to ensure the quality of public education in Virginia. In addition, the Literacy Passport Testing Program (LPT) is designed to provide a measure of how well schools prepare students for continuing education, especially in terms of traditional academic skills.

The need to evaluate the arrangement of our current educational structure is emphasized in several studies. The Virginia Department of Education is actively engaged in restructuring education at the early childhood, pre-and-early adolescent, and adolescent levels of instruction. Adolescent restructuring includes a new vision for vocational education as well as the integration of academic and occupational competencies and an emphasis on academic achievement for all students. The comprehensive V-Quest (Virginia Quality Education in the Sciences and Technology) Project should serve as an important stimulus to workforce preparation as well as to academic excellence.

Other examples of workforce-related educational initiatives

involve the continuing development of Tech Prep projects, the expansion of apprenticeship programs, and further efforts on the part of educators to establish partnerships with employers.

The Role of Employers

Partnerships among business and educational institutions are emphasized throughout the literature. Cooperation in the development of such partnerships is an important role for employers.

As noted previously, Zemsky and Cappelli (1992) point out that business must "stop blaming the worker." In The Education Smokescreen, Jonathan Weisman (1992) proposed that businesses stop blaming schools as well and cites evidence that preparation of a skilled, productive workforce can occur from within business. In an admonition against enterprise's reinforcing the lowest common skill denominator, he points out that "because Johnny cannot or does not want to read, McDonald's puts a picture of a hamburger on the cash register to press."

Robert Reich (1992), in a recent article in Harper's Magazine, suggests the following ways to improve employee training: encourage more employers to offer training, include more low-level position workers in the training programs, and increase the amount of funding dedicated to training. Reich points out that Japanese firms, for example, spend an average of $1,000 more per worker, per year, than their American counterparts.

Workers should come to businesses with basic skills, but further training usually is needed. What training will be offered, how that training will be provided, and how much training is actually needed are questions to be answered. Small businesses dominate the total number of American firms, a figure reflected by Virginia statistics as well. Frank Swoboda (1992), in the Washington Post, recounts that, according to the Small Business Administration, businesses with fewer than 20 employees (which account for more than 90% of the total number of businesses in operation) created more than four million jobs between 1988 and 1990. However, these are the very businesses which may lack the resources necessary to train workers.

Holton's (1991) study notes that organizations generally are not working very hard to socialize their employees. He states that "organizations and the managers within those organizations often do not focus on developing sound new employee development practices. They work hard to do a good job of hiring people, offer good task-related training, work hard to evaluate their performance, and focus intently on identifying candidates for promotion, but forget to help employees make the transition from naive outsider to productive insider" (p. 136). High employee turnover or decreased

productivity can cost an organization much in terms of lost financial and human resources.

Virginia may fare better than other states in the area of worker training: in a survey published in Training and Education: The Virginia Employer's View, Martin and Carrier (1991) found that only 23% of respondents considered their skilled and semi-skilled workers unprepared, and that a third, 33%, wanted external agencies (schools, government, etc.) to do "nothing" for them.

The majority of studies were in agreement that employers must increase their overall help in training the workforce and that formal education alone cannot fully prepare the evolving global workforce. The literature described several successful ways that employers can help prepare workers. Examples include conducting in-house training of **all** workers; creating faculty exchange programs; and increasing employer involvement with apprenticeship, mentorship, and other related programs.

The Role of Workers

Perhaps no stronger conduit exists between education and enterprise than workers. Numerous studies suggest that they too must shoulder the responsibility of workforce preparation in such diverse ways as ensuring that their career choice is appropriate, choosing their education according to available and effective occupational routes, and adopting a "life-long learner" attitude. In addition, workers should make efforts to become more self-reflective concerning their job performance.

In a Washington Post article, Frank Swoboda (1992) profiles a "new" worker at the Blacksburg Corning ceramics plant: 24 years old, with a baccalaureate degree in business administration and three associate degrees as well. As the U.S. Department of Labor Report (1992), "Economic Change and the American Workforce," states, "The competitive workplace today is a high-skill environment designed around technology and people who are technically competent. Workers must now understand their work as part of a much larger whole."

The Role of Public Policy Representatives

Zemsky and Cappelli (1992) emphasize that effective public policy can "create the linkages among business, education, and the labor force that generate a flexible workforce" (p. 6). They point out that public agencies are expected to play three principal roles in creating appropriate linkages: ensuring the quality of compulsory public education, providing information and facilitating communication, and assisting in the formation of funding mechanisms for sharing the cost of general work-related education and training.

Virginia has made considerable progress in workforce preparation. In addition to the education initiatives previously noted, the Workforce Leadership Council has been established. This organization, composed of state agency heads who direct employment and training activities, has been formed in direct response to recommendations made by the Workforce 2000 Task Force. The Council is charged with reviewing the delivery of all education, employment, and training programs for increased efficiency and effectiveness.

A Business/Education Partnership Program and Resource Center also has been established, supported by public and private funds. The Center is responsible for promoting local business/education partnerships and improving students' school-to-work transition.

Much has been done in Virginia to build the linkages necessary to support business, education, and workers. The makers of public policy can build on their accomplishments by continuing to create incentives to encourage education and business to work together in providing education and training programs. Public policy representatives also can continue to facilitate access to occupational preparation programs, promote increased career counseling services, and enhance coordination efforts among all educational levels. Above all, public policy representatives can help to streamline efforts to enable present and potential workers to develop the critical competencies, as identified in Chapter II, for the 21st century.

Summary

Academic, personal, and interpersonal skills are emphasized throughout the literature as critical competencies of the 21st century worker. All classification systems contain the message that workers need to work both alone and as a member of a team. There is a shift in the workplace from work broken into discrete, isolated segments performed autonomously, repetitively, and under direct supervision to work for which teams of workers take direct responsibility.

The educational system must be rapidly restructured to develop the necessary competencies to work in this new way if the nation's workforce is to be ready for the 21st century.

Cooperation among business personnel, educators, workers, and public policy representatives is necessary to prepare a workforce for the 21st century.

CHAPTER II. FINDINGS

The procedures employed in this study, which may serve as a model for the study of other industries, are provided in Appendix B. In addition to the literature review described in Chapter I, procedures included the collection of information from business representatives and educators, analyses of findings, conclusions, and recommendations.

Information from Manufacturing Businesses: The Mail Survey

The survey included analyses of both present and future critical competencies of entry-level employees and first-line supervisors. Development of the survey instrument (Appendix C) was based on competencies repeatedly identified in the literature. The final survey form encompassed 57 worker skills representing a synthesis of the competencies identified in the literature. The skills included on the survey instrument were organized according to the following categories: **reasoning and problem solving, speaking and listening, teamwork, personal work habits, reading, writing, computation, and business principles.** The survey form was sent to businesses involved in complex manufacturing technologies throughout the Commonwealth, including both large (sometimes employing hundreds) and small (sometimes employing fewer than ten) businesses. The survey targeted the businesses throughout the state identified by the Virginia Manufacturers Association.

Respondents were first asked to identify the three skills within each category that they felt were most critical for present-day entry-level workers and first-line supervisors. Following this, they were asked to repeat the process for future (defined as five years from now) entry-level workers and first-line supervisors. Five years was determined by the study team to be both far enough in the future to constitute a viable distinction from the present and near enough to the present to provide a confident forecast.

Survey results were obtained by tabulating all responses and choosing, by order of response frequency, the three skills most often cited for each category. In addition, surveys were further divided into responses from small businesses and responses from large businesses. Results of the analyses of entry-level worker skills, present and future, identified by both large and small businesses are located in Appendix D. First-line supervisor competency analyses, present and future, indicated by large and small firms, are provided in Appendix E.

Survey Respondents

Survey forms were sent to the following businesses and to the Virginia Manufacturers Association which responded anonymously except for a distinction between large and small firms:

Name of Business	Location
Abell Industries	Lawrenceville
Aerial Machine and Tool Corporation	Vesta
Arnold Pen Company, Inc.	Petersburg
Biological Monitoring, Inc.	Blacksburg
W. J. Carpenter Co., Inc.	Brightwood
Dean Foods Company	Sandston
Dixie Manufacturing Company	Norfolk
E. I. DuPont De Nemours & Co.	Richmond
Electromatics, Inc.	Ashland
First Colony Coffee & Tea Co.	Norfolk
Galileo Electro-Optics Corp.	Forest
The Harwood Companies, Inc.	Marion
Hofmann Mondial, Inc.	Lynchburg
IBM	Manassas
Kirk Lumber Company	Suffolk
Kosmo Machine Company	Glen Allen
Magnox Incorporated	Pulaski
Merck and Company	Elkton
Newport News Shipbuilding & Drydock	Newport News
Pond Brothers Peanuts Co.	Suffolk
RECO Industries, Inc.	Richmond
Richmond Pressed Metal Works	Richmond
Ross Industries, Inc.	Midland
Turner & Minter, Inc.	Eagle Rock
Valeo Clutches and Transmissions	Hampton
Virginia Manufacturers Association	Richmond

Numerical Breakdown of Surveys

Twenty-seven surveys were mailed and 56% or 15 completed surveys were returned. Of the completed surveys, 40% or six surveys were returned by large businesses and 60% or nine surveys were returned by small businesses. This is a relatively high response rate for a survey conducted by mail. In addition, small and large businesses were equitably balanced, with the numerically higher small business response validated by the higher number of small businesses in the Commonwealth.

Additional Response Categories

Two categories of skills were added to the survey--"Science and Technology" and "Other." These were left blank, with no corresponding skills listed, to allow for individual responses.

Survey recipients were asked to add any skill/category suggestions they felt were important, but not addressed in the survey skills listed. Individual suggestions are provided in Appendix F.

These suggestions provide some important additions to the framework for preparing a skilled workforce. Some items, such as aquatic toxicology in science and technology may seem too specific for the purposes of this study. Others, for example, biological assay techniques, may fall outside the realm of complex manufacturing technologies. Certain suggestions enhance our understanding of the skills employers look for in prospective employees.

General Survey Results

Overall, the survey findings indicate a trend both toward worker autonomy and, at the same time, interaction. Employers today seek individuals at management and entry levels who are well-grounded in the traditional academic subjects such as reading, writing, and arithmetic. In the future, academic skills will be assumed. In addition, employers will expect of workers a higher order of cognitive ability, including capacities for inference, decision making, innovation and invention, synthesis of knowledge and ideas, and an overall and continuing willingness to learn. Teamwork constitutes a standard feature of today's workplace, suggesting a shift in the mode of workplace communication from monologue to dialogue. Heightened social skills, including an awareness and understanding of others and the ability and desire to participate in group tasks, will be increasingly essential to job success.

The Critical Competencies

Critical competencies are defined as the future skills rated as first in each category of competencies, for entry-level workers and first-line supervisors, by respondents representing both large and small manufacturing firms in Virginia. Detailed listings of skill requirements both for entry-level workers and first-line supervisors, present-day and future, as indicated by large and small firms, are provided in Appendices D and E. Only future competencies for both levels of employees are shown here. The critical competency for each category is marked and appears in bold print. The decision to identify only future competencies as critical was based on the employers' insistence that "the future is now" because changes occur so rapidly at the workplace.

Future Skills of Entry-Level Workers

The following competencies were reported to be the most important for entry-level workers of the future:

Reasoning and Problem Solving

- **Devise new ways of handling recurring problems.**
  Identify problems.
  Determine what is needed to accomplish work assignment.

Speaking and Listening

- **Participate effectively in discussions.**
  Understand the intent and details of oral communications.
  Obtain, clarify, and verify information through questioning.

Teamwork

- **Participate as a team member toward a common goal.**
  Offer and accept criticism constructively.
  Demonstrate respect for the opinions, customs, and individual differences of others.

Personal Work Habits

- **Exhibit a willingness to learn.**
  Exhibit a positive attitude toward work and pride in accomplishment.
  Exhibit self-discipline, including regular and punctual attendance and dependability.

Reading

- **Assimilate the contents of technical documents and memos.**
  Interpret quantitative information in tables, charts, and graphs.
  Note details and facts.

Writing

- **Gather information necessary for a purpose.**
  Organize information in a logical and coherent manner.
  Document repair problems and action taken.

Computation

- **Add, subtract, multiply, and divide whole numbers, decimals, and fractions accurately.**
  Determine the cost, time, or resources necessary for a task.
  Estimate results and judge their accuracy.

Business Principles

- **Understand the roles of money, capital investment, product pricing, cost, profit, and productivity.**
  Understand the political, economic, and social systems of the United States and other countries.
  Distinguish among economic principles, facts, and value judgments.

It is evident that the entry-level worker of the future is expected to perform tasks that at one time would have been the responsibility of a supervisory position. Future workers must anticipate as well as solve problems; develop social skills and awareness, both of self and others; and demonstrate mastery of economic concepts, including an understanding of global competition and knowledge of macroeconomics, as well as foreign languages and cultures.

Future Skills of First-Line Supervisors

The following list represents the combined responses of both large and small businesses as they identified the three skills within each category that they perceived were the most important future skills of first-line supervisors. Critical or top-rated competencies in each category are marked and appear in bold print.

Reasoning and Problem Solving

- **Consider and evaluate possible alternative solutions, weighing both risks and benefits.**
  Devise new ways of handling recurring problems.
  Separate fact from opinion and inference.

Speaking and Listening

- **Give clear, concise instructions.**
  Obtain, verify, and clarify information through questioning.
  Understand the intent and details of oral communications.

Teamwork

- **Demonstrate respect for the opinions, customs, and individual differences of others.**
  Participate as team member toward a common goal.
  Participate as team leader.

Personal Work Habits

- **Exhibit a willingness to learn.**
  Set goals and allocate time to achieve them.
  Exhibit a positive attitude toward work and pride in accomplishment.

Reading

- **Assimilate the content of technical documents and memos.**
  Evaluate the worth and objectivity of sources.
  Identify inconsistency in written material.

Writing

- **Organize information in a logical and coherent manner.**
  Gather information necessary for a purpose.
  Use reference books and technical manuals, including a dictionary, a thesaurus, and an encyclopedia.

Computation

- **Determine the cost, time, or resources necessary for a task.**
  Apply principles of simple probability and statistics.
  Estimate results and judge their accuracy.

Business Principles

- **Understand the roles of money, capital investment, product pricing, cost, profit, and productivity.**
  Distinguish among economic principles, facts, and value judgments.
  Understand supply and demand in a free market system.

In general, the results given for first-line supervisor reflect a higher degree of cognitive abilities and decision-making skills than those listed for entry-level workers. Under "Reasoning and Problem Solving," for example, all skills listed represent abilities to choose among and synthesize options.

Survey Summary

The results of this survey, similar to those reported in related literature, reflect a workplace that is changing and will continue to change, both physically and conceptually. The skills highlighted in this survey suggest work environments no longer characterized by isolated individuals performing discrete tasks, or, in the words of one business representative, "putting tops on bottoms." Rather, workers of the future will participate as team members working together to bring a whole project to closure. The findings indicate a movement from individual project tasks performed by employees working alone to personnel working in concert on large aspects or dimensions of a project.

A difference exists, however, between perceptions of the workplace by large and small businesses responding to the survey. While the responses of the larger businesses reflect the newer workplace vision, the smaller businesses as a whole do not see this

change as quickly or completely. As indicated by the detailed data in Appendices D and E, the differences between present and future skills desired by businesses were comparatively small. This may be because smaller operations may not have the resources for changing the workplace and training workers that larger businesses may enjoy. In the words of one small business owner, "All these ideas look great on paper, but. . . ." A smaller workplace environment may also foster a closer relationship between entry-level worker and first-line supervisor, thus facilitating teamwork and participation. Moreover, there is a higher chance of promotion from within in a small business, which may reduce the disparity between the relative positions of worker and supervisor. Finally, again owing to the nature of a smaller workplace, the level of skill transferability and shared responsibility sought by larger businesses for the future may, in fact, be already attained by smaller businesses. That is, a smaller number of workers translates to a higher degree of individual flexibility required by each one. Given the much higher proportion of small than of large businesses in Virginia, the conclusions of this report should reflect the voices of small businesses throughout the Commonwealth.

Despite the differences noted between small and large manufacturers, a number of conclusions may be drawn about changes in the workplace from the present to the future. There will be:

- **A shift from task to project.**
- **An increase in teamwork.**
- **An ability to work without direct supervision.**
- **An increase in worker flexibility.**
- **A requirement that workers be willing to learn.**
- **A mastery of traditional basic academic skills as a starting point for job success.**
- **A higher level of cognitive ability required for workers.**
- **A movement toward individual responsibility, toward workers as stakeholders.**
- **An increased understanding of global economic principles.**

Information from Manufacturing Businesses: Interviews, Conferences, and Correspondence

In addition to the mail survey, considerable workforce information was obtained from manufacturing businesses as a result of interviews, correspondence, and conferences.

Responses to Interview Questions

Interviews were conducted with firms large enough to have formal procedures for employment and training. These firms included E. I. Dupont DeNemours & Company, Ford Motor Company, IBM, Kosmo Machine Company, Merck and Company, and Newport News Shipbuilding. The interview questions are located in Appendix C.

In general, there has been little or no employment of entry-level personnel or first-line supervisors for the past year or longer. The businesses can be very selective when they do employ regularly or frequently at either level. Smaller firms tend to prefer apprentices to other types of entry-level workers.

The mid-management level is being eliminated in the restructuring process, resulting in many operator-level employees reporting to one first-line supervisor. At one firm, Dupont, there are seven levels of operators, but only one level of supervisors. Examples of entry-level job titles, in addition to operator, are machinist, service worker, and maintenance mechanic. First-line supervisors may be given such titles as shift manager, team leader, resource manager, or design supervisor.

The screening process can be quite complex, beginning with careful analysis of the application form in terms of accuracy, neatness, and promptness in returning the completed form. At least three employment tests may be given, including mathematics and mechanical aptitude. Both in-house and commercial tests are used. Observations of applicants to note their interaction skills and potential success in teams may be a critical aspect of the screening process, even for young (18-year-old) entry-level applicants. The companies interviewed are more likely to promote from within rather than employ someone from outside for a first-line supervisor position.

Training is provided by the manufacturing businesses in such areas as basic skills (remediation to improve reading, writing, and mathematics), the operation of specific equipment, the performance of a particular job, general updating, teamwork, and management techniques. The need for training is ongoing, due to the speed of change. As several industry representatives remarked, "The future is now."

Characteristics of the ideal entry-level worker and first-line supervisor are provided in detail in Appendices D and E. For purposes of this study, the ideal employee is considered to be one who has mastered the critical competencies.

Business Representation at Project Conferences

Business representatives actively participated in and enthusiastically supported the two major events of the study, "Manufacturing Workforce 2000" (July 24, 1992, Appendix G) and "Education for Workforce 2000" (August 24-25, 1992, Appendix H). They discussed issues and trends among themselves and presented these to the educators who attended both meetings. The primary message was that business was eager to engage in partnerships with education to enable students to develop the critical competencies required for an ever-changing workplace and a global economy.

The focus-group conference provided the primary forum for educators and business representatives to discuss education in relation to workforce issues. Correspondence from both business participants and educators resulted from the focus groups.

Information from Educators: Recommendations from Focus Groups

Dr. Peter J. Denning, Chairman of the George Mason University Computer Science Department, presented the keynote address at the "Education for Manufacturing Workforce 2000" meeting, entitled "Educating a New Engineer." Dr. Denning presented a proposal for curriculum development that "reformulates the curriculum around exhibitions of competent performance, reformulates the means and measures of assessment so that faculty success depends on student success, and provides an informational infrastructure that permits us to work with our students in the same kind of communication environment that will be common for them in the years ahead" (p.26). Denning takes the position that practical, work-based applications will prove to be effective learning strategies in higher education.

Following Dr. Denning's presentation, recommendations were developed and presented by the educators who attended the "Education for Workforce 2000" conference. The focus groups included business representatives and were organized according to the three instructional levels: secondary; community college; and senior college, including graduate programs.

Secondary Education Recommendations

The secondary educators recommended that school administrators and other educators accept the critical competencies identified in the business mail survey as requirements for the workforce and infuse these competencies into existing courses. In addition, the secondary educators emphasized that individuals supporting public schools should help change public and professional perceptions of

the need for workforce preparation by conducting in-service and pre-service sessions for all educators on the importance of workforce issues, supporting pilot programs involving business leaders and teachers, and developing resource materials for improving workforce preparation. Correspondence providing concrete suggestions for change resulted from business participation in the secondary focus group,[1] as well as support for the partnership effort.[2]

Community College Recommendations

Community college administrators and faculty also recommended that the community colleges accept the critical competencies as identified in the business mail survey as requirements for the workforce and infuse these competencies into existing courses. In addition, this focus group recommended that the community colleges assist faculty and staff in developing and delivering instruction that includes the critical competencies; support articulation among all levels of education for appropriate placement of the critical competencies in the curricula; improve transition services for adults pursuing training or retraining to include the critical competencies; and promote parental involvement in students' career development, helping to foster a smooth transition from school to work.

Senior Institutions' Recommendations

Participants in the focus group for senior college institutions directed their recommendations to the institutions, to business and industry, and to the State Council of Higher Education.

To the Institutions

The senior institutions were asked to encourage business and industry's input into the development of engineering and engineering-related curricula and to familiarize prospective

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[1]Robert Kyle, Director of Human Resources for the Virginia Manufacturers Association recommended the following in a letter dated September 2, 1992: endorse the Literacy Passport Testing Program and build upon it by examining how work ethic values could be integrated into the curriculum; consider extending the school day and the school year; integrate skills such as reading, writing, listening and speaking, keyboarding, data manipulation, problem solving, analysis, synthesis, evaluation, decision making, time management, and applied math and science, including probability, statistics, measurement, and logic; avoid treating preparation for the workforce as the "poor stepchild to an academic or college prep track"; follow the example of the German apprenticeship program that "produces **educated**, not just **trained**, workers"; and "engage students in actively using information, not just passively receiving it" in academic as well as occupational preparation programs.

[2]Michael Wall, External Programs Manager for Dupont, writes, in a letter dated August 27, 1992, "I support the educators' desire that business increase its involvement in the education system for the purpose of ensuring clear understandings of the educational needs employers have for their prospective employees."

engineers with industry by requiring enrollment in cooperative education courses earlier than the senior year. Engineering programs should also integrate communications skills into their curricula, for example, by bringing English faculty into the laboratories to share instructional responsibilities and by stressing written, verbal, and listening skills, as well as audience awareness, in all classes. In addition, programs should improve inter-faculty communication, particularly between business and engineering faculty, and help keep faculty current with employment trends and the latest technological developments in business and industry. Finally, institutions should require technological literacy of all students.[3]

To Business and Industry

Suggestions made to business and industry included the need to communicate with faculty about employment trends and needs; describe for education the importance of professionalism and the characteristics that define it; encourage cooperative and intern programs for students; and support exchange programs in which engineering faculty work within industry and practicing engineers teach at institutions.

To The State Council of Higher Education

The senior institutions' focus group recommended that the Council support faculty and staff development programs such as the previously mentioned faculty exchange programs. The Council should also promote communication across educational levels in order to ensure that the critical competencies are taught throughout the curriculum and to ensure a smooth education-to-career transition.

Summary of Focus Groups

Secondary, community college, and senior college officials all indicated their interest in continuing with the business/education joint effort to improve workforce preparation. The time is right, the need is now, and the parties are willing to participate in a partnership designed to coordinate the placement needs of students, the program development needs of educational institutions, the workforce needs of business and industry and the economy of the Commonwealth. Interests and desires reflected in both conferences included in the study are reflected in the conclusions and recommendations of Chapter III.

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[3]Evidence of educator support for improved workforce preparation is provided through sample correspondence from educators who were project participants. For example, Dr. Thomas W. Haas, Director of Cooperative Graduate Engineering at Virginia Commonwealth University, sent an article and a letter that noted, "All concerns expressed (by business) were essentially non-technical in nature. Apparently, the engineering schools are doing an excellent job of teaching undergraduate science, mathematics, and engineering, but other areas, e.g., communication skills, interpersonal skills, etc. are where there is cause for concern."

CHAPTER III. CONCLUSIONS AND RECOMMENDATIONS

The conclusions and recommendations presented here have been reached as a result of conducting the study, discussing workforce issues with business representatives and educators at three instructional levels, and analyzing the findings.

General Conclusions

The following conclusions are based on the findings from a study limited to the Commonwealth of Virginia and to the occupational field of complex manufacturing technology:

1. The workforce data gathered in this study are similar to the information reported as national trends and reflect the current labor market literature.

2. There has been a pattern of **low or no** employment of entry-level and first-line supervisory personnel during the past year or longer in the manufacturing firms involved in this study.

3. Employers can be very selective when they do employ workers and tend to choose only those who can demonstrate mastery of the critical competencies identified in this study.

4. Applicants lacking the critical competencies are not considered for employment even at the entry level, and this situation is likely to become more prevalent in the future; employers especially expect proficiency in the traditional basic skills and screen out applicants who fail to demonstrate these skills.

5. Those who are employed are expected to demonstrate higher order cognitive skills, to excel at teamwork and interaction, to solve immediate and recurring problems, to handle crises without seeking assistance from their supervisors, and to manage their own continuing education and personal development.

6. Small manufacturing firms differ from large business organizations in their perceptions of the need for dramatic changes in workforce competencies and tend to prefer apprenticeships to other forms of entry-level employment.

7. Educators are concerned about placing their graduates and wonder if program completers will be employed even if they develop the critical competencies.

8. Representatives of manufacturing firms involved in this study are interested in working with educators, and some are willing to explore extensive partnership arrangements, such as expansion of cooperative education, apprenticeships, mentorships, internships, and consultation on program design.

9. Study participants representing complex manufacturing technology and education at three instructional levels reached agreement on identification of the critical competencies.

10. Development of the critical competencies can be infused into the instructional programs of secondary schools, community colleges, and senior educational institutions at appropriate levels of depth and complexity.

The Major Conclusion

If the current trend in complex manufacturing technology continues, only those applicants who can demonstrate the critical competencies identified in this study are likely even to be considered for employment. If students at all instructional levels are to be prepared for the present and future workforce, they must be specifically, practically, and realistically prepared for a very challenging and demanding job and career scenario with nothing certain but change. In the opinion of the study team, the Virginia workforce will **not** be prepared for the 21st century unless the critical competencies are developed.

Recommendations

The following recommendations are based on findings and conclusions of the study and are offered as measures to help ensure that the Virginia workforce will be ready for the 21st century:

1. The Workforce Leadership Council (WLC), composed of agency heads with employment and training responsibilities, should coordinate the various workforce preparation studies and initiatives to produce a statewide program designed to ensure development of the critical competencies identified in this study.

2. The workforce preparation program should include implementation and evaluation of efforts to develop the critical competencies; provision for youth and adults who have had no opportunities to be prepared for the present or future workforce; and a public information campaign to inform students, parents, educators, and employers of the urgency of workforce preparation for the 21st century.

3. A team of business representatives and educators representing secondary schools, community colleges, and senior educational institutions should formulate recommendations for development of the critical competencies at appropriate levels of depth and complexity, including staff development programs focusing on workforce issues and trends in relation to the counseling and career preparation of students.

4. Whenever possible, secondary schools, community colleges, and senior colleges and universities should provide supervised employment or simulated workforce experience for all students, as well as career counseling services.

5. Partnerships with employers should be expanded to facilitate the development of the critical competencies, to arrange for actual or simulated employment opportunities for students and faculty, and to determine the critical competencies that could be taught by business representatives. The Business/Education Partnership Program and Resource Center could assist in this endeavor, and individuals at educational institutions could coordinate education/business and industry relationships and staff development in workforce issues and trends.

6. The Department of Education, within its comprehensive educational restructuring effort, should fully implement the following actions, which are already underway and which reflect the systemic changes envisioned by the State Board of Education in its adoption of the document, "Virginia's Vision For A World-Class Education":

   a. The Common Core of Learning (to be completed at the end of the tenth grade);

   b. Development of the eleventh- and twelfth-grade instructional programs;

c. Further development of Tech Prep programming, in cooperation with the Virginia Community College System, to enable qualified students to begin this comprehensive, multi-level curriculum while in secondary school; and

d. Continuing development of the apprenticeship program, in cooperation with the Department of Labor and Industry, to meet the needs of small businesses as well as to provide new employment opportunities for students.

BIBLIOGRAPHY

Works Cited

American Society for Training and Development. (1983). Models for excellence. Alexandria: American Society for Training and Development.

Atwell, Robert H. (1992). Financial prospects for higher education. Policy perspective: The Pew higher education research program, 4(3), 5-7B.

Carnevale, Anthony P., Leila J. Gainer, and Ann S. Meltzer. (1991). Workplace basics: The essential skills employers want. San Francisco: Jossey-Bass.

Commission on the Skills of the American Workforce. (1990). America's choice: High skills or low wages! Rochester: National Center on Education and the Economy.

Governor's Advisory Committee Workforce 2000: A Partnership for Excellence. (1991). The Virginia plan for strengthening the commonwealth's 21st century workforce. Richmond: Commonwealth of Virginia.

Hamburg, David A. (1992). The family crucible and healthy child development. New York: Carnegie Corporation of America.

Holton, III, Elwood F. (1991). Organizational entry by new college graduates: Implications for human resource development and universities. Unpublished doctoral dissertation, Virginia Polytechnic and State University, Virginia.

MDC, Inc. (1992). Greater expectations: The south's workforce is the south's future. Advisory panel on southern workforce development. Chapel Hill: MDC, Inc.

Martin, J. H., and A. H. Carrier. (1991, April). Training and education: The Virginia employer's view. University of Virginia Newsletter, pp. 1-8.

National Academy of Sciences. (1984). High schools and the changing workplace: The employer's view. Washington: National Academy Press.

O'Reilly, Brian. (1992, August). The job drought. Fortune, pp. 62-74.

Reich, Robert B. (1992, September). Education reform: Don't count on business. Harper's Magazine, pp. 26-28.

The Secretary's Commission on Achieving Necessary Skills. (1991). What work requires of schools: A SCANS report for America 2000. Washington: U. S. Department of Labor.

Swoboda, Frank. (1992, August). A new breed on the line: Factories of future will have good jobs--for the qualified few. Washington Post, p. H1, H4.

Swoboda, Frank. (1992, September). Looking to lighten a load. Washington Post, p. H1, H7.

U. S. Department of Labor. (1992). Economic change and the American workforce. Washington: Government Printing Office.

Virginia Department of Economic Development. (1992). 1992 fact and figures. Richmond: Commonwealth of Virginia.

Virginia Employment Commission, Economic Information Services Division. (1991). Virginia's workforce 2000. Richmond: Virginia Employment Commission.

Weisman, Jonathan. (1992, May). The education smokescreen. Phi Delta Kappan, p. 721.

Zemsky, Robert and Peter Cappelli. (1992, July). The EQW triangle. EQW Issues. National Center on the Educational Quality of the Workforce, pp 1-8.

Suggested Readings

American Society for Training and Development. (1988). Info-Line. Alexandria: American Society for Training and Development.

Bailey, Thomas. (1991). Jobs of the future and the education they will require: Evidence from occupational forecasts. Educational Researcher, 20(2), 11-20.

Bottoms, Gary, and Presson, Alice. (1989). Improving general and vocational education in the high schools. Atlanta: Southern Regional Education Board.

Carnevale, Anthony P. (1991). America and the new economy. San Francisco: Jossey-Bass.

Carnevale, Anthony P., Gainer, Leila J., & Schultz, Eric R. (1990). Training the technical workforce. San Francisco: Jossey-Bass.

Center for Public Resources. (1983). Basic skills in the U. S. workforce. Washington: Center for Public Resources.

Council of Chief State School Officers. (1992). State initiatives for school and the workplace. Washington: Council of Chief State School Officers.

Daggett, Willard R. (1991). Identifying the skills students need for success in the workplace: Implications for curriculum and assessment. Schenectady: International Center for Leadership in Education.

Daggett, Willard R. (1990). Preparing for employment in the 1990s. Albany: New York Education Department.

Denning, Peter J. (1992). Educating A new engineer. (Draft 5, 8/20/92). George Mason University, Virginia.

Dyke, Jr., James W. (1992, October 5). Public schools can profit from business involvement. Richmond-Times Dispatch.

Harper, Lucinda.(1992, August 28). Gap between incomes of rich and poor is called widest in south and southwest. Wall Street Journal, (no page listed).

Hodgkinson, Harold L. (1992). A demographic look at tomorrow. Washington: Institute for Educational Leadership, Center for Demographic Policy.

Kash, Don E., & Willenbrock, F. Karl. (1992, Summer). Engineering education for the workers of the future." Issues in Science and Technology, pp. 30-34.

Martin, J. H., & Tolson, D. J. (1985). Changing job skills in Virginia: The employer's view. Charlottesville: Tayloe Murphy Institute and Virginia Occupational Information Coordinating Committee.

Page, Andrew P. (1992, July). Systems engineering and information technology: catalysts for total quality in industry and education. George Mason University, Virginia.

Personick, V. A. (1989). Industry output and employment: A slower trend for the nineties. Monthly Labor Review, 112(11), 25-41.

Sargent, Jon, and Pfleeger, Janet. (1990). The job outlook for college graduates to the year 2000: A 1990 update. Occupational Outlook Quarterly, 34(2), 2-9.

Semerad, R. D. (1987). Workers in the year 2000: Why we're in trouble. American Teacher, 71(8), 7-12.

Southern Regional Education Board. (1988). Goals for education: challenge 2000. Atlanta: SREB.

Southport Institute for Policy Analysis. (1992). The missing link: A new model for workforce education in small business. Workforce Development Strategies, 4(4), 1-8.

State Higher Education Executive Officers. (1992). Workforce preparation self-study guide. (Draft) Denver: SHEEO.

Stein, Herbert. (1992, August 28). "The bogus jobs' problem. Wall Street Journal.

Swoboda, Frank. (1992, September 6). A new breed on the line. Washington Post, p. H1, H4.

Tolson, Donna, Martin, Julia H., & Carrier, Achsah H. Adult training and education: The students. University of Virginia News Letter, 68(5), 1-8.

Virginia Department of Economic Development. (1991). Economic developments 1991: A statistical summary. Richmond: Commonwealth of Virginia.

Virginia Secretary of Economic Development. (1992). Virginia economic development policy. Richmond: Commonwealth of Virginia, Department of Economic Development.

APPENDICES

Appendix A. House Joint Resolution No. 143

Appendix B. Model Procedures for Study of An Occupational Area: Complex Manufacturing Technology

Appendix C. Mail Survey Instrument and Interview Questions: Information from Manufacturing Businesses

Appendix D. Entry-Level Worker Competencies Present and Future Large and Small Manufacturing Businesses

Appendix E. First-Line Supervisor Competencies Present and Future Large and Small Manufacturing Businesses

Appendix F. Additional Response Categories: Science and Technology and Other Competencies

Appendix G. Project Event # 1: "Manufacturing Workforce 2000," July 24, 1992 Program and Participants

Appendix H. Project Event # 2: "Focus: Education for Manufacturing Workforce 2000" August 24-25, 1992 Program and Participants

APPENDIX A.

HOUSE JOINT RESOLUTION NO. 143

LD4283280

HOUSE JOINT RESOLUTION NO. 143

AMENDMENT IN THE NATURE OF A SUBSTITUTE

(Proposed by the House Committee on Rules
on February 7, 1992)

(Patron Prior to Substitute—Delegate Harris)

Requesting the State Board of Education and the State Council on Higher Education jointly to study the efficacy of current education and workforce training initiatives in the Commonwealth's public schools and institutions of higher education in preparing a skilled workforce for the 21st century.

WHEREAS, manufacturing, as Virginia's largest basic employer, is an integral component of the Commonwealth's economy and ultimate growth, and provides jobs for over 400,000 citizens in every county and city in Virginia; and

WHEREAS, increasingly complex manufacturing technology, such as numerical control machinery, and computer integrated and flexible response manufacturing, demand the development of a productive workforce with the educational and professional skills necessary to compete in an ever-changing global economy; and

WHEREAS, the Governor's Advisory Committee on Workforce Virginia 2000: A Partnership for Excellence has stated that the Commonwealth must "set higher educational and productivity standards for its workforce or risk being unprepared to compete in the international arena, losing ground to countries with less-educated but less-expensive workforces as well as to those with better-educated and more productive workforces"; and

WHEREAS, the link between education and economic development has long been recognized by economists and development experts and has been examined by numerous executive and legislative study committees, including the Governor's Advisory Committee on Workforce 2000, the Commission on the University of the 21st Century, and the A. L. Philpott Southside Economic Development Commission; and

WHEREAS, enhancing the mathematics and sciences training in our public schools, improving graduation rates, and increasing the numbers of students pursing higher or continuing education are essential to the development of a productive workforce that can compete effectively in the international economy; and

WHEREAS, while the multi-faceted missions of Virginia's public schools and its two- and four-year institutions of higher education have embraced not only more traditional educational pursuits but also vocational and workforce training, further study is necessary to determine accurately the efficacy of current initiatives in preparing the Commonwealth's citizens for full, productive lives and to assess the need for additional programs; now, therefore, be it

RESOLVED by the House of Delegates, the Senate concurring, That the State Board of Education and the State Council on Higher Education be requested jointly to study the efficacy of current education and workforce training initiatives in the Commonwealth's institutions of higher education in preparing a skilled workforce for the 21st century.

The Board and the Council shall submit their joint findings and recommendations to the Governor and the 1993 Session of the General Assembly in accordance with the procedures of the Division of Legislative Automated Systems for the processing of legislative documents.

APPENDIX B.

MODEL PROCEDURES FOR STUDY OF AN OCCUPATIONAL AREA:

COMPLEX MANUFACTURING TECHNOLOGY

The Model Procedures: Study Approach Based on the Manufacturing Industry

Using the manufacturing industry as the focus of the research approach, the study team conducted the following procedures:

1. Completed a computer search of related literature/ research, seeking as indicators of effectiveness in workforce preparation:

   a. Researched general workforce skills for the 21st century

   b. Researched skills for entry-level and first-line supervisory level in manufacturing;

2. Reviewed and summarized related literature;

3. Obtained information from manufacturing businesses to determine employment and training trends, general skills common to manufacturing now and in the near future, and indicators of workforce effectiveness:

   a. Interviewed Virginia Manufacturing Association representative, Robert Kyle, Director of Human Resources

   b. Interviewed W. R. McDonald, Dupont Human Resources Manager (for management-level personnel) and Claude Edmonds, Section Manager (for entry-level employees)

      (1) Piloted business interview questionnaire

      (2) Determined major trends in employment and training of first-line supervisors and entry-level workers (seven levels of operators at Dupont) in a large, pace-setting manufacturing organization

   c. Conducted meeting with representatives of large and small manufacturing businesses with study team members, and other educators at a function entitled, "Manufacturing Workforce 2000," held at the Hyatt Hotel, July 24, 1992

   d. Surveyed by mail large and small manufacturing businesses to determine critical skills for the present and future; developed instrument for the survey from related literature and contributions of manufacturing personnel

e. Analyzed all information collected from manufacturing businesses;

4. Conducted focus groups of educators from three levels of instruction--secondary (middle and high school), community college, and senior institutions of higher education--and representatives of manufacturing businesses at a function entitled, "Focus: Education for Manufacturing Businesses," held at the Jefferson Hotel, August 24-25, 1992:

   a. Arranged for a paper to be presented, indicating the use of demonstration and authentic assessment through exhibitions at the baccalaureate and graduate levels of instruction--"Educating the New Engineer"

   b. Presented a panel discussion of human resources manufacturing representatives to determine and present to participant educators the most important characteristics of future employees

   c. Conducted three separate focus groups--secondary, community college, and senior college level, including graduate programs--with business executives and educators as participants to determine their recommendations to be incorporated within the study

   d. Coordinated the presentation of each focus group's recommendations to the full group;

5. Analyzed the information collected from the focus groups in relaton to data available from the literature and from manufacturing businesses; and

6. Developed conclusions and recommendations based on findings from all sources.

Two additional procedures were planned, but not executed, due to lack of research time: (1) a survey of labor organizations concerning skills to be developed and training desired and (2) technical analyses of skills for manufacturing occupations, involving the use of the DACUM (Develop A Curriculum) process and technical committees.

APPENDIX C.

MAIL SURVEY INSTRUMENT

AND

INTERVIEW QUESTIONS

Information from

Manufacturing Businesses

BUSINESS/INDUSTRY SURVEY
PREPARING A SKILLED WORKFORCE

Skill	Entry-level Worker		First-line Supervisor	
	Present	Future	Present	Future
Reasoning and Problem Solving				
Identify problems.				
Consider and evaluate possible alternative solutions, weighing both risks and benefits.				
Formulate and reach decisions logically.				
Separate fact from opinion and inference.				
Adjust to unanticipated situations by applying established rules and facts.				
Devise new ways of handling recurring problems.				
Determine what is needed to accomplish work assignment.				
Apply the scientific process.				
Diagnose malfunctions accurately.				
Speaking and Listening				
Communicate in standard English.				
Understand the intent and details of oral communications.				
Give clear, concise instructions.				
Identify and summarize correctly principal and subsidiary ideas in discussions.				
Obtain, clarify, and verify information through questioning.				
Participate effectively in discussions.				

Skill	Entry-level Worker		First-line Supervisor	
	Present	Future	Present	Future
Principles of Teamwork				
Interact in a socially appropriate manner.				
Demonstrate respect for the opinions, customs and individual differences of others.				
Offer and accept criticism constructively.				
Handle conflict maturely.				
Participate as team member toward a common goal.				
Participate as team leader.				
Personal Work Habits				
Exhibit a realistic, positive attitude toward one's self.				
Exhibit a positive attitude toward work and pride in accomplishment.				
Exhibit a willingness to learn.				
Exhibit self-discipline, including regular and punctual attendance and dependability.				
Set goals and allocate time to achieve them.				
Accept responsibility.				
Work with or without supervision.				
Exhibit appropriate dress, grooming, and hygiene.				
Work within an organization's rules, policies and procedures.				

Skill	Entry-level Worker		First-line Supervisor	
	Present	Future	Present	Future
Reading				
Assimilate the content of technical documents and memos.				
Note details and facts.				
Distinguish between and summarize principal and subsidiary ideas.				
Identify inconsistency in written material.				
Verify information.				
Evaluate the worth and objectivity of sources.				
Interpret quantitative information in tables, charts, and graphs.				
Writing				
Gather information necessary for a purpose.				
Organize information in a logical and coherent manner.				
Apply the rules of correct syntax, spelling, punctuation, and capitalization.				
Attribute references correctly.				
Use reference books and technical manuals including a dictionary, a thesaurus, and an encyclopedia.				
Document repair problems and action taken.				

Skill	Entry-level Worker		First-line Supervisor	
	Present	Future	Present	Future
Computation				
Add, subtract, multiply, and divide whole numbers, decimals, and fractions accurately.				
Calculate distance, weight, area, volume, and time.				
Convert from one measurement system to another, for example, from English to metric.				
Determine the costs, time, or resources necessary for a task.				
Compute costs.				
Apply principles of simple probability and statistics.				
Calculate using information obtained from charts, graphs, and tables.				
Use ratios, proportions, percentages, and algebraic equations with a single unknown.				
Estimate results and judge their accuracy.				
Business Principles				
Understand the political, economic, and social systems of the United States and other countries.				
Understand the roles of money, capital investment, product pricing, cost, profit, and productivity.				
Distinguish the differences between economic principles, facts, and value judgments.				
Know the forms and functions of local, state, and federal governments.				
Understand supply and demand in a free market system.				

Skill	Entry-level Worker		First-line Supervisor	
	Present	Future	Present	Future
Science and Technology				
Other				

INTERVIEW QUESTIONS ASKED OF MANUFACTURING BUSINESS REPRESENTATIVES

1. Who (number and type of individual) has been employed during the past year, and who do you anticipate employing in the future?

2. What are typical entry-level and first-line supervisor occupations within your organization?

3. What procedures are used in processing potential personnel prior to employment? (Please include the screening/narrowing process and numbers where possible.)

4. What kind of training is required to be considered for entry-level employment and for first-line supervisor employment within your organization (skills brought to the application process)?

5. Do you use any type of testing or other screening device during the application process? If so, is it "in-house" or commercially obtained?

6. What training is provided by your organization after employment at the following levels: (1) entry-level (2) first-line supervisor? What are the objectives of training after employment?

7. What roles do unions play? Are they reactive? proactive? neutral?

8. How would you describe the ideal entry-level and first-line supervisor personnel?

APPENDIX D.

ENTRY-LEVEL WORKER COMPETENCIES

Present and Future

Large and Small Manufacturing Businesses

BUSINESS/INDUSTRY SURVEY RESULTS
PREPARING A SKILLED WORKFORCE

Present-day Entry-level Worker[1]

Reasoning and Problem Solving

Formulate and reach decisions logically.
Adjust to unanticipated situations by applying established rules and facts.
Diagnose malfunctions accurately.

Speaking and Listening

Understand the intent and details of oral communications.
Communicate in standard English.
Give clear, concise instructions.

Principles of Teamwork

Participate as team member toward a common goal.
Interact in a socially appropriate manner.
Demonstrate respect for the opinions, customs, and individual differences of others.

Personal Work Habits

Exhibit a willingness to learn.
Exhibit a positive attitude toward work and pride in accomplishment.
Exhibit self-discipline, including regular and punctual attendance and dependability.

Reading

Interpret quantitative information in tables, charts, and graphs.
Assimilate the contents of technical documents and memos.
Note details and facts.

Writing

Organize information in a logical and coherent manner.
Gather information necessary for a purpose.
Document repair problems and action taken.

Computation

Add, subtract, multiply, and divide whole numbers, decimals, and fractions accurately.
Calculate using information obtained from charts, graphs, and tables.
Calculate distance, weight, area, volume, and time.

Business Principles

Understand the roles of money, capital investment, product pricing, cost, profit, and productivity.
Understand supply and demand in a free market system.
Understand the political, economic, and social systems of the United States and other countries.

[1] This list represents the three skills identified most by the Business/Industry panel in the survey.

LARGE BUSINESS/INDUSTRY SURVEY RESULTS
PREPARING A SKILLED WORKFORCE[1]

Skills Needed for Present-day Entry-level Worker

Reasoning and Problem Solving

Formulate and reach decisions logically.
Adjust to unanticipated situations by applying established rules and facts.
Diagnose malfunctions accurately.

Speaking and Listening

Understand the intent and details of oral communications.
Communicate in standard English.
Give clear, concise instructions.

Principles of Teamwork

Participate as team member toward a common goal.
Interact in a socially appropriate manner.
Demonstrate respect for the opinions, customs, and individual differences of others.

Personal Work Habits

Exhibit a willingness to learn.
Exhibit a positive attitude toward work and pride in accomplishment.
Exhibit self-discipline, including regular and punctual attendance and dependability.

Reading

Interpret quantitative information in tables, charts, and graphs.
Assimilate the contents of technical documents and memos.
Note details and facts.

Writing

Organize information in a logical and coherent manner.
Gather information necessary for a purpose.
Document repair problems and action taken.

Computation

Add, subtract, multiply, and divide whole numbers, decimals, and fractions accurately.
Calculate using information obtained from charts, graphs, and tables.
Calculate distance, weight, area, volume, and time.

Business Principles

Understand the roles of money, capital investment, product pricing, cost, profit, and productivity.
Understand supply and demand in a free market system.
Understand the political, economic, and social systems of the United States and other countries.

[1] This list represents in order of response frequency the three skills identified most by the Large Business/Industry personnel in the survey.

SMALL BUSINESS/INDUSTRY SURVEY RESULTS
PREPARING A SKILLED WORKFORCE[1]

Skills Needed for Present-day Entry-level Worker

Reasoning and Problem Solving

Identify problems.
Formulate and reach decisions logically.
Determine what is needed to accomplish work assignment.

Speaking and Listening

Participate effectively in discussions.
Understand the intent and details of oral communications.
Communicate in standard English.

Principles of Teamwork

Participate as team member toward a common goal.
Interact in a socially appropriate manner.
Offer and accept criticism constructively.

Personal Work Habits

Exhibit a willingness to learn.
Exhibit a positive attitude toward work and pride in accomplishment.
Exhibit self-discipline, including regular and punctual attendance and dependability.

Reading

Note details and facts.
Verify information.
Assimilate the contents of technical documents and memos.

Writing

Gather information necessary for a purpose.
Organize information in a logical and coherent manner.
Document repair problems and action taken.

Computation

Add, subtract, multiply, and divide whole numbers, decimals, and fractions accurately.
Estimate results and judge their accuracy.
Determine the cost, time, or resources necessary for a task.

Business Principles

Understand the roles of money, capital investment, product pricing, cost, profit, and productivity.
Understand supply and demand in a free market system.
Understand the political, economic, and social systems of the United States and other countries.

[1] This list represents in order of response frequency the three skills identified most by the Small Business/Industry personnel in the survey.

LARGE BUSINESS/INDUSTRY SURVEY RESULTS
PREPARING A SKILLED WORKFORCE[1]

Skills Needed for Future Entry-level Worker (Defined as five years from the present)

Reasoning and Problem Solving

Devise new ways of handling recurring problems.
Consider and evaluate possible alternative solutions, weighing both risks and benefits.
Apply the scientific process.

Speaking and Listening

Obtain, clarify, and verify information through questioning.
Participate effectively in discussions.
Give clear, concise instructions.

Principles of Teamwork

Participate as team member toward a common goal.
Offer and accept criticism constructively.
Participate as team leader.

Personal Work Habits

Exhibit a willingness to learn.
Exhibit a positive attitude toward work and pride in accomplishment.
Accept responsibility.

Reading

Assimilate the contents of technical documents and memos.
Interpret quantitative information in tables, charts, and graphs.
Evaluate the worth and objectivity of sources.

Writing

Gather information necessary for a purpose.
Organize information in a logical and coherent manner.
Use reference books and technical manuals including a dictionary, a thesaurus, and an encyclopedia.

Computation

Estimate results and judge their accuracy.
Determine the cost, time, or resources necessary for a task.
Apply principles of simple probability and statistics.

Business Principles

Understand the roles of money, capital investment, product pricing, cost, profit, and productivity.
Distinguish the differences among economic principles, facts, and value judgments.
Understand the political, economic, and social systems of the United States and other countries.

[1] This list represents the three skills in order of response frequency identified most by the Large Business/Industry personnel in the survey.

SMALL BUSINESS/INDUSTRY SURVEY RESULTS
PREPARING A SKILLED WORKFORCE[1]

Skills Needed for Future Entry-level Worker (Defined as five years from the present)

Reasoning and Problem Solving

Identify problems.
Formulate and reach decisions logically.
Determine what is needed to accomplish work assignment.

Speaking and Listening

Participate effectively in discussions.
Understand the intent and details of oral communications.
Communicate in standard English.

Principles of Teamwork

Participate as team member toward a common goal.
Offer and accept criticism constructively.
Interact in a socially appropriate manner.

Personal Work Habits

Exhibit a willingness to learn.
Exhibit a positive attitude toward work and pride in accomplishment.
Exhibit self-discipline, including regular and punctual attendance and dependability.

Reading

Verify information.
Note details and facts.
Assimilate the contents of technical documents and memos.

Writing

Gather information necessary for a purpose.
Organize information in a logical and coherent manner.
Document repair problems and action taken.

Computation

Add, subtract, multiply, and divide whole numbers, decimals, and fractions accurately.
Calculate using information obtained froom charts, graphs, and tables.
Determine the cost, time, or resources necessary for a task.

Business Principles

Understand the roles of money, capital investment, product pricing, cost, profit, and productivity.
Understand supply and demand in a free market system.
Understand the political, economic, and social systems of the United States and other countries.

[1] This list represents in order of response frequency the three skills identified most by the Small Business/Industry personnel in the survey.

APPENDIX E.

FIRST-LINE SUPERVISOR COMPETENCIES

Dupont Selection Criteria

Present and Future Competencies
from Mail Survey

of

Large and Small Manufacturing Businesses

FIRST LINE SUPERVISOR

SELECTION CRITERIA

DUPONT

1. A person who is flexible, willing and able to accept and lead change, and who has the resiliency to bounce back from adversity.

2. A person who exhibits energy and enthusiasm; who is obviously motivated to achieve personal and business goals and who is a self-starter toward these goals.

3. A person who wants to grow personally, to become all that he or she has the potential to be.

4. A person who wants to see other people grow, and become all that he or she has the potential to be.

5. A person who learns from all those with whom he or she comes in contact.

6. A person who has good reasoning ability and good judgment and is able to draw conclusions and make decisions after analyzing the situation.

7. A person with the interpersonal relationship skills to get along well with people.

8. A person who has appropriate communication skills (speaking, listening, writing) to be a leader.

9. A person who models behavior consistent with our culture.

10. A person who desires to be in the role of and accepts the responsibility of an organizational leader.

11. A person who takes what he or she learns from others and life experiences and applies the learning to his or her work.

12. A person who is objective, also empathetic (capable of seeing it from the other person's point of view).

13. A person who is resourceful and creative in solving problems and reaching resolution.

14. A person who is knowledgeable of the work of first-line manager.

TOTAL BUSINESS/INDUSTRY SURVEY RESULTS
PREPARING A SKILLED WORKFORCE[1]

Skills Needed for Present-day First-line Supervisor

Reasoning and Problem Solving

Devise new ways of handling recurring problems.
Consider and evaluate possible alternative solutions, weighing both risks and benefits.
Formulate and reach decisions logically.

Speaking and Listening

Give clear, concise instructions.
Participate effectively in discussions.
Understand the intent and details of oral communications.

Principles of Teamwork

Demonstrate respect for the opinions, customs, and individual differences of others.
Participate as team member toward a common goal.
Participate as team leader.

Personal Work Habits

Set goals and allocate time to achieve them.
Exhibit a positive attitude toward work and pride in accomplishment.
Exhibit self-discipline, including regular and punctual attendance and dependability.

Reading

Assimilate the content of technical documents and memos.
Evaluate the worth and objectivity of sources.
Identify inconsistency in written material.

Writing

Organize information in a logical and coherent manner.
Gather information necessary for a purpose.
Use reference books and technical manuals including a dictionary, a thesaurus, and an encyclopedia.

Computation

Determine the cost, time, or resources necessary for a task.
Estimate results and judge their accuracy.
Apply principles of simple probability and statistics.

Business Principles

Understand the roles of money, capital investment, product pricing, cost, profit, and productivity.
Understand supply and demand in a free market system.
Distinguish the differences between economic principles, facts, and value judgments.

[1] This list represents the three skills in order of response frequency identified most by the combined Business/Industry personnel in the survey.

LARGE BUSINESS/INDUSTRY SURVEY RESULTS
PREPARING A SKILLED WORKFORCE[1]

Skills Needed for Present-day First-line Supervisor

Reasoning and Problem Solving

Devise new ways of handling recurring problems.
Consider and evaluate possible alternative solutions, weighing both risks and benefits.
Determine what is needed to accomplish work assignments.

Speaking and Listening

Give clear, concise instructions.
Participate effectively in discussions.
Understand the intent and details of oral communications.

Principles of Teamwork

Participate as team member toward a common goal.
Demonstrate respect for the opinions, customs, and individual differences of others.
Participate as team leader.

Personal Work Habits

Set goals and allocate time to achieve them.
Work within an organization's rules, policies, and procedures.
Work with or without supervision.

Reading

Interpret quantitative information in tables, charts, and graphs.
Evaluate the worth and objectivity of sources.
Note details and facts.

Writing

Organize information in a logical and coherent manner.
Gather information necessary for a purpose.
Document repair problems and action taken.

Computation

Determine the cost, time, or resources necessary for a task.
Calculate using information obtained from charts, graphs, and tables.
Apply principles of simple probability and statistics.

Business Principles

Understand the roles of money, capital investment, product pricing, cost, profit, and productivity.
Understand supply and demand in a free market system.
Distinguish the differences between economic principles, facts, and value judgments.

[1] This list represents the three skills in order of response frequency identified most by the Large Business/Industry personnel in the survey.

SMALL BUSINESS/INDUSTRY SURVEY RESULTS
PREPARING A SKILLED WORKFORCE[1]

Skills Needed for Present-day First-line Supervisor

Reasoning and Problem Solving

Formulate and reach decisions logically.
Identify problems.
Consider and evaluate possible alternative solutions, weighing both risks and benefits.

Speaking and Listening

Give clear, concise instructions.
Participate effectively in discussions.
Understand the intent and details of oral communications.

Principles of Teamwork

Demonstrate respect for the opinions, customs, and individual differences of others.
Participate as team member toward a common goal.
Participate as team leader.

Personal Work Habits

Exhibit a willingness to learn.
Exhibit a positive attitude toward work and pride in accomplishment.
Set goals and allocate time to achieve them.

Reading

Assimilate the contents of technical documents and memos.
Evaluate the worth and objectivity of sources.
Distinguish between and summarize principal and subsidiary ideas.

Writing

Organize information in a logical and coherent manner.
Gather information necessary for a purpose.
Use reference books and technical manuals including a dictionary, thesaurus, and an encyclopedia.

Computation

Determine the cost, time, or resources necessary for a task.
Estimate results and judge their accuracy.
Add, subtract, multiply, and divide whole numbers, decimals, and fractions accurately.

Business Principles

Understand the roles of money, capital investment, product pricing, cost, profit, and productivity.
Distinguish the differences between economic principles, facts, and value judgments.
Understand supply and demand in a free market system.

[1] This list represents in order of response frequency the three skills identified most by the Small Business/Industry personnel in the survey.

TOTAL BUSINESS/INDUSTRY SURVEY RESULTS
PREPARING A SKILLED WORKFORCE[1]

Skills Needed for Future First-line Supervisor (Defined as five years from the present)

Reasoning and Problem Solving

Consider and evaluate possible alternative solutions, weighing both risks and benefits.
Devise new ways of handling recurring problems.
Separate fact from opinion and inference.

Speaking and Listening

Give clear, concise instructions.
Obtain, clarify, and verify information through questioning.
Understand the intent and details of oral communications.

Principles of Teamwork

Demonstrate respect for the opinions, customs, and individual differences of others.
Participate as team member toward a common goal.
Participate as team leader.

Personal Work Habits

Exhibit a willingness to learn.
Set goals and allocate time to achieve them.
Exhibit a positive attitude toward work and pride in accomplishment.

Reading

Assimilate the content of technical documents and memos.
Evaluate the worth and objectivity of sources.
Identify inconsistency in written material.

Writing

Organize information in a logical and coherent manner.
Gather information necessary for a purpose.
Use reference books and technical manuals including a dictionary, a thesaurus, and an encyclopedia.

Computation

Determine the cost, time, or resources necessary for a task.
Apply principles of simple probability and statistics.
Estimate results and judge their accuracy.

Business Principles

Understand the roles of money, capital investment, product pricing, cost, profit, and productivity.
Distinguish the differences between economic principles, facts, and value judgments.
Understand supply and demand in a free market system.

[1] This list represents the three skills in order of response frequency identified most by the combined Business/Industry personnel in the survey.

LARGE BUSINESS/INDUSTRY SURVEY RESULTS
PREPARING A SKILLED WORKFORCE[1]

Skills Needed for Future First-line Supervisor (Defined as five years from the present)

Reasoning and Problem Solving

Consider and evaluate possible alternative solutions, weighing both risks and benefits.
Devise new ways of handling recurring problems.
Adjust to unanticipated situations by applying established rules and facts.

Speaking and Listening

Understand the intent and details of oral communications.
Obtain, clarify, and verify information through questioning.
Participate effectively in discussions.

Principles of Teamwork

Demonstrate respect for the opinions, customs, and individual differences of others.
Participate as team member toward a common goal.
Participate as team leader.

Personal Work Habits

Set goals and allocate time to achieve them.
Exhibit a willingness to learn.
Exhibit a positive attitude toward work and pride in accomplishment.

Reading

Assimilate the contents of technical documents and memos.
Distinguish between and summarize principal and subsidiary facts.
Interpret quantitative information in tables, charts, and graphs.

Writing

Gather information necessary for a purpose.
Organize information in a logical and coherent manner.
Use reference books and technical manuals including a dictionary, a thesaurus, and an encyclopedia.

Computation

Determine the cost, time. or resources necessary for a task.
Apply principles of simple probability and statistics.
Use proportions, percentages, and algebraic equations with a single unknown.

Business Principles

Understand the roles of money, capital investment, product pricing, cost, profit, and productivity.
Distinguish the differences between economic principles, facts, and value judgements.
Understand supply and demand in a free market system.

[1] This list represents the three skills in order of response frequency identified most by the Large Business/Industry personnel in the survey.

SMALL BUSINESS/INDUSTRY SURVEY RESULTS
PREPARING A SKILLED WORKFORCE[1]

Skills Needed for Future First-line Supervisor (Defined as five years from the present)

Reasoning and Problem Solving

Identify problems.
Formulate and reach decisions logically.
Consider and evaluate possible alternative solutions, weighing both risks and benefits.

Speaking and Listening

Give clear, concise instructions.
Participate effectively in discussions.
Understand the intent and details of oral communications.

Principles of Teamwork

Demonstrate respect for the opinions, customs, and individual differences of others.
Participate as team member toward a common goal.
Participate as team leader.

Personal Work Habits

Exhibit a willingness to learn.
Exhibit a positive attitude toward work and pride in accomplishment.
Set goals and allocate time to achieve them.

Reading

Assimilate the contents of technical documents and memos.
Evaluate the worth and objectivity of sources.
Distinguish between and summarize principal and subsidiary ideas.

Writing

Organize information in a logical and coherent manner.
Gather information necessary for a purpose.
Use reference books and technical manuals including a dictionary, thesaurus, and an encyclopedia.

Computation

Determine the cost, time, or resources necessary for a task.
Add, subtract, multiply, and divide whole numbers, decimals, and fractions accurately.
Estimate results and judge their accuracy.

Business Principles

Understand the roles of money, capital investment, product pricing, cost, profit, and productivity.
Distinguish the differences between economic principles, facts, and value judgments.
Understand supply and demand in a free market system.

[1] This list represents in order of response frequency the three skills identified most by the Small Business/Industry personnel in the survey.

APPENDIX F.

ADDITIONAL RESPONSE CATEGORIES

Science and Technology Competencies

Other Competencies

SUMMARY OF ADDITIONAL RESPONSE CATEGORIES

Science and Technology Competencies

Other Competencies

Science and Technology

- Environmental regulations
- Chemical assay techniques
- Aquatic toxicology
- Concepts of water quality
- Basic computer skills
- Geometric tolerancing
- Standard blueprint reading
- Basic computer literacy
- Statistical process control
- Basic understanding of chemistry, physics, and biology
- Ability to apply some engineering principles
- Ability to learn new scientific and technological information
- Apply the scientific method to problem solving
- Evaluate the credibility of scientific claims in popular magazines and newspapers
- Understand the scientific and technological background of equipment and processes in own current field--know how things work

Other

- Just-in-time manufacturing
- Statistical process control
- Employee work team theory
- Gains the respect and trust of others
- Principles of negotiation
- Quality control/assurance
- Marketing
- Accepts the responsibility of self-development
- Is flexible without violating basic operations and behavior principles

APPENDIX G.

PROJECT EVENT # 1:

"MANUFACTURING WORKFORCE 2000"

Program and Participants

July 24, 1992

MANUFACTURING WORKFORCE 2000

A Meeting of Manufacturing Business Representatives and
State Agencies Participating in HJR 143:
Study of Preparing A Skilled Workforce

Hyatt Hotel
Washington Room
July 24, 1992

9:30 a. m.–3:30 p. m.

9:30 a. m.-Noon

WELCOME FROM DEPARTMENT OF EDUCATION	Dr. Edward W. Carr Chief of Staff Department of Education
WELCOME FROM STATE COUNCIL OF HIGHER EDUCATION	Dr. Genene Pavlidis Academic Affairs Coordinator State Council of Higher Education
WELCOME FROM VIRGINIA COMMUNITY COLLEGE SYSTEM	Dr. Melton R. Jones Acting Assistant Vice Chancellor for Instructional Programs and Student Services, Virginia Community College System
INTRODUCTIONS AND PROJECT ROLES	All Participants
PROJECT OVERVIEW AND RELATIONSHIP TO OTHER STATE INITIATIVES	Dr. Kay Brown Associate Specialist Marketing Education Department of Education
MANUFACTURING EMPLOYMENT AND TRAINING TRENDS	Panel Discussion: Representatives of Marketing Businesses

WORLD-CLASS EDUCATION AND THE RESTRUCTURING OF EDUCATION	Dr. Ida J. Hill Deputy Superintendent for Student Services
12:00-12:45 p.m.	
LUNCH	
12:45-3:30 p.m.	
THE IDEAL EMPLOYEE: CRITICAL MANUFACTURING SKILLS–NOW AND IN THE FUTURE	Dr. Warren Hayman Writer-Editor Virginia Vocational Curriculum and Resource Center
SUMMARY/NEXT STEPS	Dr. Kay Brown

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APPENDIX H.

PROJECT EVENT # 2:

"FOCUS: EDUCATION FOR MANUFACTURING WORKFORCE 2000"

Program and Participants

August 24-25, 1992

FOCUS: EDUCATION FOR

MANUFACTURING WORKFORCE 2000

JEFFERSON HOTEL

August 24-25, 1992

August 24, Monday

10:00 a.m.-11:00 a.m.	Registration	Empire Room
11:00 a.m. -12:00 Noon	Welcome to Workforce 2000: *Dr. Dana B. Hamel, Executive Director* *Virginia Center for Public/Private Initiatives*	
	Introductions	
	Project Overview	
	Mission of the Focus Groups	
12:00 Noon-1:00 p.m.	Lunch	Rotunda
1:00 p.m.-2:30 p.m.	Educating A New Engineer	Empire Room
	Dr. Peter J. Denning, Chair *Department of Computer Science* *George Mason University*	
	Discussion	
2:30 p.m.-2:45 p.m.	Break	
2:45 p.m.-5:00 p.m.	Panel of Human Resources Executives in Manufacturing Businesses:	
	Trends in Manufacturing Employment and Training	
	Hugh Davis, Manager of Maintenance and Production Training *Newport News Shipbuilding and Dry Dock Company*	

Leonard Fields, Associate Personnel Manager
Merck and Company

Edward Lewis, Education and Training Manager
IBM

W. R. McDonald, Human Resources Manager
E. I. Du Pont De Nemours & Company

Audience Participation in Panel Discussion

Orientation of Focus Groups

DINNER ON YOUR OWN

Tuesday, August 25

8:30 a.m.-10:00 a.m.	FOCUS GROUPS	
	Senior Higher Education Institutions Focus Group	Harrison Room
	Community College Focus Group	Roosevelt Room
	Secondary Focus Group	Grand Ballroom
10:00 a.m.-10:15 a.m.	Break	
10:15 a.m.-11:00 a.m.	Focus Groups (continued)	
11:00 a.m.-12:30 p.m.	Reports/Recommendations from Focus Groups	
	Summary/Next Steps	
	Adjournment	

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